For Angeles: **Criteria for Stop Work Order on ST12**

Issue: Despite the written objections and formal disapproval of both regulatory agencies, Amec, as agent for AF, prematurely terminated steam injection on March 4, 2016 while thousands of pounds of hydrocarbons were still being removed on a daily basis. Just 8 weeks later on April 29, 2016 with the subsurface still very hot, Amec terminated the extraction system which was supposed to contain the mobile hot fluids as the site cooled. During the interim, it was revealed that there is significantly more LNAPL in the subsurface than what AF had previously disclosed to the regulatory agencies, and the SEE system had not been designed to efficiently address all of the remaining LNAPL, due to inadequate initial characterization. Following the joint agency letter of May 3, 2016 disapproving termination of the extraction system, and without consulting the regulatory agencies, Amec immediately began dismantling the multimillion dollar Steam Enhanced Extraction System, effectively preventing the agencies from being able to order it turned back on. As of the June 22, 2016 BCT call, Amec confirmed that there is very little remaining of the SEE system infrastructure.

What we want AF to do now:

1. **Immediately stop work on any further efforts to proceed with Enhanced Bioremediation Workplan.** EPA's comment letter and attachments of June 17, 2016 documents technical concerns and effectively disapprove the workplan.
2. **Immediately resume extraction at existing wells to reestablish hydraulic containment to prevent hot fluids from spreading and help to cool the site.** This is consistent with the previous interim measure that followed the shutdown of the TEE pilot, to prevent spreading of the plume and cool the site while the SEE system was being designed.
3. **Complete full site-wide characterization to document the quantity and extent of NAPL, groundwater-dissolved BTEX, BTEX concentrations within the NAPL and the extent and behavior of the dissolved BTEX+N plume.** Only following characterization and *full disclosure* of site conditions will the technical team be able to make an informed decision as to the most appropriate next steps.

Why what AF/Amec is doing is different from what all parties agreed to in the 2013 ROD Amendment:

- The 2013 RODA selected Steam Enhanced Extraction as the mechanism to remove the LNAPL source from the site, to be followed sequentially by Enhanced Bioremediation to biologically degrade dissolved phase contaminants after steam treatment has removed the LNAPL source and most of the lighter BTEX constituents. It is generally acknowledged by bioremediation vendors that bioremediation is not an appropriate technology to degrade NAPL, thus, we could not have anticipated at the time of RODA signature that Amec would try to use it for that purpose, particularly because it had never been pilot tested before at this site, and *had already been evaluated and rejected under Alternative 4 in the FFS.*

- The quantity, extent and distribution of LNAPL at the ST12 site is actually far greater than was previously disclosed to the agencies; thus the SEE system was under-designed to efficiently and cost effectively remediate the full LNAPL source area. Based upon estimates provided in Amec's RDRA workplan the remaining LNAPL source after SEE could be between a quarter of a million to

over a million gallons of LNAPL still in the subsurface, and at least as much as they removed via the SEE system. SEE is the only remedy selected in the ROD with demonstrated effectiveness to address the LNAPL.

- While the RAO in the RODA does not specifically require NAPL removal, NAPL removal (i.e., removal of the benzene source material) is critical to attaining the RAO-required benzene MCL within 20 years. Note also that EPA policy is that source materials must be removed in order for MNA to be used as part of a site remedy.

Why was termination of steam premature?

- Steam was terminated while Amec was till removing thousands of pounds of hydrocarbons on a daily basis. One of the criteria Amec had proposed (not agreed upon, but not disputed) for shutdown was for recovery to be less than 10% of the peak recovery rate. While they were still instituting pressure cycling in the weeks prior to shutdown, there were days when recovery was well above 10% of peak recovery. Once they shut the system down, recovery naturally declined; however, if they had continued pressure cycling, they would still have recovery greater than 10% of peak because the system was mobilizing and capturing NAPL from outside the perimeter of the thermal treatment zone. The 2013 RODA made no distinction between LNAPL within and outside of the steam treatment system.

- There is no other remedy specified in the ROD that is appropriate for addressing large quantities of LNAPL that still remain at the site, which will be a lingering source of benzene for years to come.

What is the main concern with loss of extraction?

- Because the site subsurface is still at elevated temperatures due to the SEE treatment, COCs still have greatly enhanced mobility. The extraction system was designed to cool the site down while continuing to capture and remove the mobilized contaminants. Without the extraction system, NAPL and dissolved contaminants are at risk of spreading, particularly because groundwater levels have risen into the highly transmissive cobble zone.

- AF has long asserted that the benzene plume is stable and not spreading with the rising water table, but we now know the extent of contamination is much larger and greater than they ever characterized or disclosed to us. Given the similar geology to other Phoenix area plumes e.g. M52, Indian Bend Wash) that are tens of miles long, we simply do not have the data to substantiate AF's claim that the plume is not spreading.

- The 2013 RODA declared the remedy to be protective of human health and the environment because "there is no current use of ground water at ST012 and institutional controls will prevent future use of groundwater until cleanup levels are achieved." This cannot be guaranteed if the LNAPL or dissolved contaminants spread beyond the boundary of the ST12 institutional controls.

The surrounding downgradient property is already transferred to Phoenix Mesa Gateway Airport.

What are the Main Concern with AF's EBR approach?

- We do not know the current extent or quantity of LNAPL and dissolved plume at the site, and have no basis to evaluate the efficacy of their EBR injections.

- The EBR workplan provides no milestones for measuring efficacy of injections over time.

- The 2013 RODA specifies that they have a 20 year period of MNA to determine if RAOs are met. That means, once EBR is implemented, EPA will not be able to declare remedy failure or require AF to take any further action until 2033, (20 years from date of RODA signature).

- The proposed injection of thousands of tons of sodium sulfate solution into the subsurface will
  i) greatly increase the salinity of the site;
  ii) has the potential to generate hydrogen sulfide gas which could be a public health hazard.
  iii) The material they are planning to use may contain up to 3 mg/kg arsenic, resulting in an injection solution 100 times the arsenic MCL; it is unclear if this is allowable under State law.
  iv) the workplan does not contain adequate contingency planning to address any of these possible outcomes.

Conclusion: There is far more LNAPL mass in the subsurface than previously disclosed by AF and the SEE system was under-designed to address the actual site conditions. EBR was intended to be a "polishing step" for degrading dissolved contaminants but cannot "polish off" LNAPL. We cannot allow AF to implement full scale EBR as proposed just to see what will happen, because the RODA language grants a 20 year MNA period, effectively functioning as a moratorium on any further response until 2033. The most immediate concern is hydraulic containment of the plume to prevent hot fluids from spreading, and to fully characterize the remaining contamination.